

## EXECUTIVE SUMMARY

This report documents the methods and technical criteria used by staff of the South Florida Water Management District to develop minimum flows for the Northwest Fork of the Loxahatchee River. The Loxahatchee River and Estuary watershed is located on the southeastern coast of Florida in Martin and Palm Beach counties. It includes the Northwest, Southwest and North Forks of the Loxahatchee River, a major drainage canal (C-18), the surrounding watershed, and the estuary. This system is of particular importance because the Northwest Fork was designated as Florida's first Wild and Scenic River, in 1985. It is located at the southern end of the Indian River Lagoon (part of the National Estuary Program), and includes a State Park and Aquatic Preserve.

Florida law requires the water management districts to develop a priority list and schedule for the establishment of minimum flows and levels for surface waters and aquifers within their jurisdiction (Section 373.042(1), Florida Statutes). This list, included in the *District Water Management Plan* for the South Florida Water Management District (SFWMD 2000a), identified the need to develop minimum flows and levels for the Loxahatchee River.

The minimum flow is defined as the "...limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." For purposes of establishing minimum flows, significant harm is defined as the temporary loss of water resource functions which result from a change in surface or ground water hydrology, that takes more than two years to recover, but which is considered less severe than serious harm. Water resource functions protected under Chapter 373 include flood control, water quality, water supply and storage, fish and wildlife, navigation, and recreation. Water management districts must also consider any changes and structural alterations that have occurred, and develop a recovery and prevention strategy for water bodies that do not or are not expected to meet the proposed criteria during the planning horizon.

The focus of this report is on the development of MFL criteria for the Northwest Fork of the Loxahatchee River to protect the remaining floodplain swamp community and downstream estuarine resources against significant harm. Due the lack of recent flow or biological data from the North Fork, the inability to regulate flow from the North Fork and the highly altered nature of the Southwest Fork, these two arms of the Loxahatchee Estuary were not considered for MFL establishment at this time.

Prior to development, nearly level, poorly drained lands, which were subject to frequent flooding characterized most of the region. The current managed system includes a primary and several secondary drainage systems and associated water control facilities that have been constructed to make this region suitable for agricultural and residential development. Structural changes that were considered during criteria development included: excavation and stabilization of the Jupiter Inlet; dredging, filling, and bulk heading within the estuary and Northwest Fork; construction of major canals (C-18) and secondary drainage systems; and construction of major water control structures, especially S-46.

Effects of such changes on regional hydrology, river flow, estuary hydrodynamics and river vegetation communities are documented. Over a century of water control and structural changes to this system have led to changes to the quality, quantity, timing, and distribution of

flows delivered to the river and estuary, resulting in hydrologic and ecological changes to the system. Increased salinity occurred in association with construction and dredging of Jupiter inlet and subsequent upstream navigational improvements, beginning in 1947. Drainage and land development activities have changed the timing and distribution of flows from the watershed to the river, to produce large discharges during wet periods and extended periods of little or no discharge during extreme dry periods. The estimated magnitudes and impacts of these changes are described in the report.

Pursuant to the requirements contained in Chapter 373 of the Florida Water Resources Act, water resource functions are identified and technical relationships of these functions to water flows and levels are described based on the best available information. This information includes: results of a literature review and incorporation of results obtained from previous investigations; analysis of current and historical flow and salinity data; interpretation of aerial photography/GIS studies of the river over time; results from river vegetation surveys; results of a preliminary river soil salinity survey; development and application of a hydrodynamic/salinity model to estimate long-term salinity trends at selected sites; development of empirical flow/salinity relationships; and modeling to determine the overall effect of consumptive uses (public water supply, agricultural and self-supplied residential wells) on the ability to provide flows to and from the Northwest Fork.

Proposed minimum flow criteria for the Northwest Fork are linked to the concept of protecting valued ecosystem components from significant harm. The specific valued ecosystem component identified for the Northwest Fork is an assemblage of six freshwater tree species that characterize the river's floodplain swamp. The designation of the Wild and Scenic River identified the floodplain swamp and its associated cypress forest as a resource of exceptional value that needs to be protected. Since cypress trees themselves appear to tolerate a wide range of salinity conditions and are slow to show a response to salinity stress, researchers at the SFWMD identified an associated community of freshwater swamp species that, as a group, appear to be a more sensitive indicator of adverse salinity conditions. Protection of these species will assure that the floodplain swamp and their associated communities of freshwater species are also protected.

The proposed minimum flows and levels criteria for the Loxahatchee River and Estuary were based on the determination of the following:

- Biological surveys were conducted along the Northwest Fork of the river to characterize vegetation changes that occur in relationship to the existing salinity gradient.
- Results showed highly correlated relationships between salinity conditions at a site and measured vegetation community parameters (canopy structure, number of species, abundance, tree height and trunk diameter, presence of saplings or seedlings). Based on these results, definitions of stress, harm, and significant harm were developed for the Northwest Fork.
- Research conducted by the SFWMD identified locations on the river where both a "healthy" and a "stressed" floodplain swamp exist (at river miles 10.2 and 9.7, respectively), and identified downstream locations where significant harm to this community is presently occurring (river mile 9.2).
- In order to protect the remaining healthy and stressed floodplain swamp community and the

area that is presently experiencing significant harm, sufficient flow should be provided from the Lainhart Dam whenever possible to maintain essentially freshwater conditions in the River upstream of river mile 9.2.

- Modeling results indicate that flows at or below 35 cubic feet per second from Lainhart Dam cause salinities in excess of 2 ppt to occur at sites where remaining stressed and harmed plant communities exist along the Northwest Fork of the Loxahatchee River. Periodic exposure to this level of salinity is associated with damage to freshwater vegetation.
- It is recognized that during periods of regional drought, it may not be possible to maintain fresh water conditions at river mile 9.2 or to meet the 35-cfs flow criterion. In order to prevent damage or stress from occurring to the floodplain swamp community at river mile 10.2 and significant harm from occurring at river mile 9.2, freshwater flows should not be allowed to decline below a discharge rate of 35 cfs at the Lainhart Dam for a period of more than 20 days, more often than once every six years

The proposed minimum flows and levels technical criteria for the Northwest Fork of the Loxahatchee River are as follows:

*Mean monthly flows of sufficient quantities of fresh water from the Lainhart Dam are required to maintain a healthy floodplain swamp and associated bald cypress habitat. This community has been identified as a valued ecosystem component of the Wild and Scenic portion of the Northwest Fork of the Loxahatchee River. During extreme dry periods, flows from Lainhart Dam may be reduced as upstream sources are depleted. If flows fall below 35 cfs for more than 20 days, the minimum flow and level criteria will be exceeded and harm will occur to floodplain resources. If these criteria are exceeded more frequently than once every six years, then significant harm and a violation of the minimum flow criteria will occur.*

Under current conditions, the river does not receive an adequate supply of fresh water during drought periods that is sufficient to meet these criteria. A MFL recovery and prevention strategy is therefore required. The recovery strategy has structural, operational and regulatory components. A series of projects has been identified in the *Lower East Coast Regional Water Supply Plan*, the *Northern Palm Beach County Comprehensive Water Management Plan* and the *Comprehensive Everglades Restoration Plan* that, when implemented, will provide sufficient additional water to the Northwest Fork to meet these flow criteria.

The operational component of the plan includes provision to meet or exceed the proposed MFL criteria whenever sufficient water is available. When new facilities are constructed to provide a connection between the Loxahatchee Slough and the regional water delivery system, operational guidelines to deliver the water needed to achieve MFLs, in concert with meeting other required water demands, will be identified.

The recommended recovery and prevention strategies also include regulatory components to constrain the amount of water withdrawn from the C-18 Canal and the surficial aquifer adjacent to the river in the future, during critical periods. In addition, it is recommended that future Environmental Resource Permits that are issued in this basin give additional consideration to the inflow needs of the river by ensuring that post-development discharge characteristics of the permitted project are not significantly different from, or provide more dry season inflow than, pre-development discharges. The ability to better manage water in the watershed will make it

possible to capture and retain water from the watershed for allocation to other uses (e.g., urban and agricultural water supply and dry-season releases to the river). Under such conditions, future peak flows to the estuaries could be reduced rather than increased. Criteria need to be developed, as part of an overall restoration effort, to ensure that adequate wet season flows are provided as needed to protect resources of the river from harm

Also included in the prevention strategy is an adaptive assessment approach to research and monitoring of the watershed, which is designed to fill gaps in our knowledge of the hydrodynamics and ecology of the Loxahatchee River and Estuary and the ability to provide additional flow to the Northwest Fork from other basins in southern Martin County. The proposed criteria will be refined as new information is assimilated into the minimum flows and levels development process.